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Reduplication as Evidence for the Geometry of Tone

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1. Introduction¹

Languages differ in their treatment of tone in reduplication. Some languages copy tone just like segmental material. Other languages fail to copy tone and must supply default or assimilated tones to the reduplicative affix. The question that will be addressed here is why tone reduplicates in some languages but not in others. Can we predict how a language will treat tone in reduplication based on other facts about the language?

To illustrate the different ways in which languages treat tone in reduplication, let us look at some examples of tone reduplication and tone non-reduplication²:

¹I would like to thank the following people for invaluable discussion, comments, and criticism of this work: Mary Clark, Lyn Frazier, Amalia Gnanadesikan, Anand Gnanadesikan, John Kingston, David Odden, Jeffrey Runner, Suzanne Urbanczyk, Ellen Woolford, members of audiences at UMass and CLS 1992, and especially John McCarthy. A shorter version of this paper was published in the proceedings of the 1992 meeting Chicago Linguistic Society.

²In languages with two tones, I will mark the high tone as [´]. The low tone will be unmarked. In languages with three tones, high will be marked with [ˊ] over the vowel, low will be [ˋ], and mid will be the unmarked vowel. Where I have given data for languages with more than three tones, I have noted the diacritics used.

(1) Tone non-reduplication: Shona (Myers 1987)

- | | | |
|---------------------------------------|---|---|
| (a) t - a - fámba
we walked | → | t - a - fámba - famba
we walked about |
| (b) ku - féyéwá
to be investigated | → | ku - féyéwá - feyewa
to be investigated (for a long time) |
| (c) ku - rwa
to fight | → | ku - rwa - i - rwa
to fight every so often without due cause |
| (d) ku - símúká
to stand up | → | ku - símúká - símuka
to get up and sit down all the time |

(2) Tone reduplication: Ewe (Ansre 1962)

- | | | |
|------------------------------|---|---|
| (a) ke
to be wide | → | keke
to be very wide |
| (b) así
hand | → | asíasí
hand by hand; easily |
| (c) fo
to beat | → | fofo
beating |
| (d) akóme
near one's body | → | akómeakóme
closer and closer to one's body |

I will suggest that these two types of reduplication are a direct result of the locus of tone in the phonological geometry. My proposal is that languages parameterize the location of tone in the phonological representation. A language may have either segmental tone or prosodic tone. If in a language tonal features are part of the segmental representation, tone must be reduplicated. When tone is represented prosodically (on the syllable or the mora), tone does not necessarily copy. This representational distinction is independently motivated by other aspects of the phonology of these two types of languages. In particular, segment-tone interactions will help in refining a diagnostic which will allow us to recognize whether a language has segmental tone or prosodic tone. We will see a correlation between segment-tone interaction and tone reduplication.

In Section 2, I give an overview of the debate about the representation of tone. I sketch both the segmental tone and prosodic tone proposals that have been made. Section 3 explores the predictions that these proposals make with respect to reduplication. In Section 4, the main proposal of this paper, the Tone Geometry Parameter, is developed. In Section 5, I present the results of a cross-linguistic survey that I have conducted. Areas for further investigation are raised in the final section.

2. Background

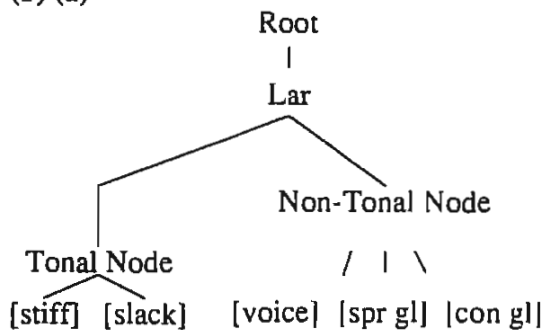
For many years, evidence has been brought forth in the phonological literature to support tone as both prosodic (Leben 1973, 1978; Goldsmith 1976; Yip 1980, 1989; Archangeli & Pulleyblank 1986; Hyman 1989; and Bao 1989 among many others) and segmental (Halle & Stevens 1971; Sagey 1986; Kingston & Solnit 1988; Bao 1990; Clark 1990; and Duanmu 1990 among others). One of the main reasons that autosegmental theory (Goldsmith 1976) was created in the

dependent on register. Bao proposes that register and tone are both dependent on a third node, the Tonal Node. These particular dependency relations are not central to the issue of this paper. The key for our purposes is that tone is prosodic, not segmental, in these theories.

The other side of this debate maintains that tone is a feature like all other segmental features. Most proponents of the segmental tone analysis claim that tone is a laryngeal feature and should therefore be represented under the laryngeal node. There are two main reasons for doing this: (1) the acoustic and articulatory properties of tone are very closely related to, and in some cases identical to, laryngeal features; and (2) having tone as a segmental feature provides an explanation for tonogenesis (the historical creation of a tone language from a non-tone language based on laryngeal feature distinctions in onsets), tonomitosi (the historical splitting of tones in a tone language as a reflection of previous voicing or glottalization distinctions in onsets), and the synchronic interaction of tone with laryngeal features. An example of synchronic segment-tone interactions is observed in the phenomenon of tone spreading. The voicing of consonants in many languages determines whether these consonants will be opaque or transparent to tone spreading. The usual case is that low tones cannot spread past voiceless consonants and high tones cannot spread past voiced consonants.

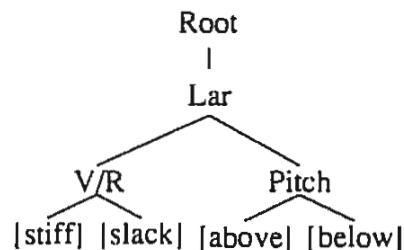
Two representative examples of a geometry treating tone as a segmental feature are given below⁴:

(5) (a)



Kingston & Solnit (1988)

(b)



Duanmu (1990)

What is important to notice about these structures is that all of the tonal features are located under the laryngeal node. Tone has the status of a segmental feature. These models are important to us because tone is represented below the root node. This proximity of tone to other laryngeal features is appealed to in explaining the segment-tone interactions mentioned above.

3. Implications of Tone Geometry

The choice of where tone is represented in the geometry makes predictions about tone in reduplication. If tone is a segmental feature, it must copy in

⁴V/R in the Duanmu geometry stands for Voicing/Register. His claim is that this is a single feature: voicing for consonants and register for tone on vowels.

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 363

reduplication. This follows from the fact that reduplication always treats segments as unanalyzable units or "islands". Except for melodic prespecification (Marantz 1982) and melodic overwriting (McCarthy & Prince 1986, 1990), the features within a segment are not accessible to individual manipulation by reduplicative copying. Thus, we do not find a rule of reduplication that copies all the segments in a word but does not copy the voicing tier, as in (6):

(6) badaka → *pataka - badaka

This islandhood of segments is found in several other domains as well: secret languages (Bagemihl 1988), stray erasure (Ito 1986), and speech errors (Shattuck-Hufnagel & Klatt 1979).

On the other hand, the claims of prosodic tone are not as strong. Whether prosodic tone copies or not depends on what is stipulated by the rule of reduplication. It is well accepted that segmental material is copied in reduplication. What is not clear is the treatment of prosodic structure (McCarthy & Prince 1986, 1988; Steriade 1988). Given a prosodic template for reduplication, such as those argued for in Marantz (1982) and McCarthy & Prince (1986), segmental material is always copied. As Steriade (1982) succinctly points out, Marantz suggests that "reduplication represents the affixation of an incompletely specified phonological unit (p. 198)." For Marantz, this phonological unit is a skeletal template of Cs and Vs to which segmental material from the base associates. McCarthy & Prince take the template to be a prosodic constituent, often a syllable. What is left unspecified in the affix template is supplied by the base. Let us consider that in some reduplication what is provided by the base is prosodic. For example, the template which is affixed to the base could be a foot. The information supplied by the base then includes moraic and possibly syllabic information. It is as if what is copied from the base is everything "below" the level of the template. If this information includes moras and syllables, then it could include tone as well, when it is attached to the mora or the syllable⁵. Further more, if the mechanism for total word reduplication were to specify a "prosodic word" template, then all prosodic structure would be copied. In this way, we can see how it could be possible for prosodic tone to reduplicate. Crucially, segmental tone must always copy. If tone is prosodic, on the other hand, it will be copied just in case reduplication copies prosodic information⁶.

4. Tone Geometry Parameter

What if both segmental tone and prosodic tone theories are correct? I propose that languages parameterize the location of tone: in some languages it is segmental, while in others it is prosodic. This representational difference allows us to explain why the behavior of tone in reduplication differs cross-linguistically. The behavior of tone is dependent on the location of tone in the phonological

⁵Steriade (1982) argues that prosodic information must be copied in reduplication in order to maintain length disjunctions. The possibility of reduplicating moras allows us to copy length as well as prosodic tone.

⁶A further question would be how prosodic tone could not reduplicate in total word reduplication. Is there evidence, for example, of moraic prespecification, as with core syllable reduplication (McCarthy & Prince 1986)? If prosodic structure were not copied from the base in some instances of total word reduplication, then prosodic tone would not copy either.

structure. In languages where tone is segmental, it copies. In languages where tone is prosodic, it will not copy unless the rule for reduplication specifies that prosodic material is copied.

There is a crucial problem in the strictly segmental theory when it comes to the case of reduplication. Segmental tone theories fail to account for languages which do not copy tone. If tone is segmental, it should copy like any other laryngeal feature. On the other hand, a theory which has only prosodic tone can handle the reduplication facts. The problem with such an account is that it fails to explain the correlation between tone reduplication and segment-tone interactions. This correlation will be made explicit in section 5.

Segment-tone interactions provide an independent test for segmental tone. If tones are prosodic, there is no reason to expect them to interact specifically with laryngeal features. If, on the other hand, tone is one of the laryngeal features, it would be natural to observe interaction between tone, voicing, glottalization, and aspiration. Indeed, these are just the segmental features that do interact with tone. Therefore, if tone interacts with laryngeal features in a language, we have grounds for claiming tone to also be a laryngeal feature in this language.

Synchronically, segment-tone interactions come in two main types: (1) the blocking of tone spreading by consonants of certain voicing values; and (2) morpheme structure constraints based on co-occurrence restrictions between onsets and tones of the following vowel. Hyman & Schuh (1974) present data from Ngizim, a Chadic language, which illustrate such blocking effects: low tones spread onto a following vowel if the intervening consonant is voiced.⁷ If the intervening consonant is voiceless, the spreading is blocked:

(7)	/mùgbá + báí/	→	[mùgbà báí]	"it's not a monitor"
	/màarém + tén/	→	[màarèm tén]	"big nose"
	/š lìtá + báí/	→	[š lìtá báí]	"it's not a pepper"
			*[š lìtá báí]	

From this example, we can see how the feature [voice] can interact with tones. Here we note that voiceless consonants block low tone spreading; this is the usual direction of interaction. The counterpart to this is when voiced consonants block the spreading of high tones. Sonorants are usually transparent to all types of tone spreading. This transparency of sonorants is consistent with having sonorants underspecified for voicing (Ito & Mester 1989; Lombardi 1991; and Urbanczyk 1992).

The other type of segment-tone interaction that we observe is that of morpheme structure constraints which refer crucially to both tone and a laryngeal feature. The most common type of interaction refers to tone and voicing of the preceding onset, though glottalization and aspiration can also play such a role. In Ewe (Peng 1992), we see co-occurrence restrictions placed on the nouns. Low tones can only follow voiced obstruent onsets, while mid and high tones can follow voiceless onsets and sonorants:

⁷The spreading only occurs if there is a high tone on the vowel following the target vowel.

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 365

(8)

	Low Tone	Mid Tone	High Tone
Voiced Onset	vù <i>fight</i>	----	----
Voiceless Onset	----	fu <i>sea</i>	fú <i>bone</i>
Sonorant Onset	----	mo <i>face</i>	mó <i>road</i>

In Lahu (Matisoff 1973), a Sino-Tibetan language, morpheme structure constraints restrict tones based on the voicing, glottalization, and aspiration of the onsets of the syllable:

(9)

Onsets	Mid Tone	High Falling Tone	Low Falling Tone	Low Tone
Aspirated Consonants	√	√	X	X
Glottalized Consonants	√	√	√	X
Plain Obstruents	√	√	√	√
Nasals	√	√	√	√
f, s, h	√	X	X	√

When we observe the kinds of segment-tone interactions illustrated in Ngizim, Ewe, and Lahu, we have motivation for claiming the language to have segmental tone.

There are many languages which exhibit no segment-tone interactions. One method for recognizing this is to check the lexicon for co-occurrence restrictions to see that morpheme structure constraints do not crucially refer to both tone and another laryngeal feature. We can see in the following Igbo data (Clark 1990) that all tones are permissible after any onset in a root:

(10)

	Voiced Onset	Voiceless Onset	Sonorant Onset
High Tone	zú <i>buy</i>	čí <i>close</i>	-wá <i>incipient</i>
Low Tone	bè <i>ever, yet</i>	fù <i>go out</i>	wè <i>pick up</i>

The other way to test a language for segment-tone interactions is to study tone spreading. We saw that in Ngizim tone spreading is sensitive to the voicing of consonants. If tones can spread past any type of consonant, we can safely conclude that laryngeal features do not interact with tone. In the example below from Shona (Myers 1987), the root has a high tone. The suffixes are underlyingly low-toned (or toneless). The high tone spreads rightward from the root and is not blocked by any type of segment:

- (11)(a) ku - téng - á (cf. ku - ereng - a)
 inf - BUY - final vowel READ
to buy
- (b) ku - téng - és - á
to sell
- (c) ku - téng - és - ér - á
to sell to
- (d) ku - téng - és - ér - án - á
to sell to each other

Levergood (1987) gives evidence demonstrating that high tone spreading in Arusa, a Nilotic language of Tanzania, is "blocked only by the preceding high tone within the same word. . ." (p.78). The following example shows a high tone spreading past a sonorant and a voiced obstruent:

- (12)
- | | | | | |
|--------------------------|---|-------------------------------|--|--------------------------------|
| n e - m - a - d o l - u | → | n e - m - a - d o l - u | | <i>I do not see him coming</i> |
| | | \ \ | | |
| H H | | H . H | | |

No evidence of segment-tone interactions can mean one of two things:

(i) This is a language in which the tone is located in the prosodic structure, attached to the syllable or the mora. Because tone is separated from the laryngeal features, there is no chance for tone to interact with laryngeal features.

(ii) This is a language in which tone is under the laryngeal node but happens not to show interactions with other laryngeal features. Just because tone does not interact with laryngeal features in a particular language, we cannot automatically assume that tone is prosodic. Therefore, negative evidence, where we see no segment-tone interactions, is not a conclusive test.

We have been looking at segment-tone interactions as evidence for segmental tone. It would be natural to turn this process around and use prosody-tone interactions as evidence for prosodic tone. Take for example a language like Mandarin Chinese, where it has been claimed that no neutral-toned syllable can bear stress (Yip 1980)⁸. The stress on a syllable makes reference to the tone. Given the standard assumption that stress is prosodic, here we see an interaction between prosody and tone. If stress' interaction with tone indicates that tone is prosodic, our claim is that stress could not have such an effect on segmental features. This claim becomes a problem when we look at the effect of stress on vowels. In Spokane (Interior Salish), all unstressed vowels are deleted, as seen in the example of reduplication below (Carlson & Flett 1989)⁹:

- (13)
- | | | |
|---|---|---|
| p'in | → | p'p'n'p'in' |
| <i>long objects lying on the ground</i> | | <i>long objects are lying on the ground</i> |

⁸Yip (1980) takes the "neutral tone" to be an underlying tone with register but no tone specifications. The tone is determined by spreading but the register is determined lexically.

Whatever the theoretical assumptions, this tone does contrast with the other tones of the language.

⁹Yip (1980) also claims that tones on unstressed syllables in Shanghai must be deleted. This parallels the Spokane case.

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 367

Another example is the familiar rule of English in which unstressed vowels are reduced to [ə]. These cases show stress having an effect on vowel quality. If tone is segmental, there is no reason why stress cannot have a similar effect on "tone quality". Therefore, prosody-tone interaction is not a valid diagnostic for prosodic tone. The reason for this conclusion stems from the type of interaction observed. Interaction between features is not in itself a diagnostic for the features being on the same tier. It is the "passive" interaction of the type we see in spreading and blocking as well as Morpheme Structure Constraints that indicates proximity. "Active" processes, such as the deletion seen above with stress, regularly occur between features of differing tiers and tell us nothing about the organization of the features involved.

The Tone Geometry Parameter predicts certain correlations between the behavior of tone in reduplication and segment-tone interactions:

(14)

	<i>Tone Reduplication</i>	<i>Tone Non-Reduplication</i>	<i>Both Tone Reduplication and Non-Reduplication</i>
<i>Segment-Tone Interactions</i>	Segmental Tone	Predicted Never to Occur	Predicted Never to Occur
<i>No Segment-Tone Interactions</i>	Cannot Diagnose	Prosodic Tone	Prosodic Tone

This chart lays out what the Tone Geometry Parameter predicts for all possible combinations of segment-tone interactions and tone reduplication. We can see that if a language has segment-tone interactions, it will necessarily reduplicate tone as well. This is because only segmental tone can interact with laryngeal features and segmental tone necessarily reduplicates. If there were a language in which tone interacted with segments but did not reduplicate, the Tone Geometry Parameter would be shown to be incorrect.

The other thing to notice about the predictions laid out in the chart is that if tone is not reduplicated in a language, that language must have prosodic tone. The only unclear case is when tone reduplicates but there is no evidence of segment tone interactions. We cannot tell if tone is segmental or prosodic in such a language based only on these two criteria. In such an instance, tone could be segmental but just happen not to interact with laryngeal features. On the other hand, the tone could actually be prosodic, but the rule of reduplication stipulate that prosodic material be copied.

The last column in the chart, "Both Tone Reduplication and Non-Reduplication," does not refer to inconsistent behavior. A few languages have different rules of reduplication for different word classes. For example, in Mandarin (Yip 1980), classifiers and verbs reduplicate tone while adjectives do not reduplicate tone. Rules of reduplication can differ from each other in whether they specify syllable reduplication or total word reduplication (McCarthy & Prince 1986). Similarly, distinct rules for distinct word classes can differ in whether they specify the copying of prosodic material.

5. Language Facts

To see if this correlation between segment-tone interactions and tone reduplication is held up by the data, let us look at a sample of thirteen different languages selected from six distinct language families (the references for the languages are given in the bibliography and examples of the behavior of each language are given in the appendices):

(15)

<i>Language Family</i>	<i>Language</i>	<i>Reduplicated Tone</i>	<i>Segment-Tone Interactions</i>	<i>Conclusion</i>
Austro-Asiatic	Vietnamese	Yes&No	No	Prosodic Tone
Bantu	Kihehe	No	No	Prosodic Tone
	Kinande	No	No	Prosodic Tone
	Shona	No	No	Prosodic Tone
Chadic	Margi	Yes	No	Can't Diagnose
	Ngizim	Yes	Yes	Segmental Tone
Kwa	Akan	No	No	Prosodic Tone
	Ewe	Yes	Yes	Segmental Tone
	Igbo	Yes	Yes	Segmental Tone
	Yoruba	Yes&No	No	Prosodic Tone
Nilotic	Arusa	No	No	Prosodic Tone
Sino-Tibetan	Lahu	Yes	Yes	Segmental Tone
	Mandarin	Yes&No	No	Prosodic Tone

We can see from this chart that the predictions of the Tone Geometry Parameter are borne out. There is an absolute correlation between segment-tone interactions and tone reduplication: if a language has segment-tone interactions it will also reduplicate tone. What is absent in the chart is of equal interest. There are no languages which have segment-tone interactions and fail to reduplicate tone. This is the case that is predicted never to occur and indeed we see no evidence that it does.

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 369

Our chart of predictions, filled in with the languages found in the sample, looks like this:

(16)

	<i>Tone Reduplication</i>	<i>Tone Non-Reduplication</i>	<i>Both Tone Reduplication and Non-Reduplication</i>
<i>Segment-Tone Interactions</i>	4 Ngizim, Ewe, Igbo, Lahu	0	0
<i>No Segment-Tone Interactions</i>	1 Margi	5 Kihche, Kinande, Shona, Akan, Arusa	3 Vietnamese, Yoruba, Mandarin

In terms of the proportion that these languages represent within the sample, we find:

(17)

	<i>Tone Reduplication</i>	<i>Tone Non-Reduplication</i>	<i>Both Tone Reduplication and Non-Reduplication</i>
<i>Segment-Tone Interactions</i>	31%	0%	0%
<i>No Segment-Tone Interactions</i>	8%	38%	23%

Let us compare these numbers with the numbers expected by chance if segment-tone interactions and tone reduplication were completely independent phenomena:

(18)

	<i>Tone Reduplication</i>	<i>Tone Non-Reduplication</i>	<i>Both Tone Reduplication and Non-Reduplication</i>
<i>Segment-Tone Interactions</i>	12%	12%	7%
<i>No Segment-Tone Interactions</i>	27%	21%	16%

These numbers are based on the sample taken, so the predictions might not hold universally. However, since these thirteen languages represent six different language families and since there is distinct behavior noted within families, we have reason to be fairly confident of the numbers derived from this sample.

What is important to notice is the discrepancy between predicted and actual percentage of representation. The cases which the Tone Geometry Parameter predicts will never occur should represent close to 20% of the languages. Instead we find 0%. The chance that this would be the case if segment-tone interactions and tone reduplication were not related in any way is 2.2%. This is almost the most significant percentage away from chance as possible. It is ten times more likely that we would have found the configuration predicted by chance. This casts doubt on the hypothesis that segment-tone interactions and tone reduplication are independent processes. In fact, these numbers strongly support the claim that segment-tone interactions and tone reduplication are interdependent just as the Tone Geometry Parameter predicts.

Of possible interest is the fact that only one language, Margi, exhibits tone reduplication without segment-tone interactions, the "Cannot Diagnose" case. Unlike the two cases just noted, this rarity is not predicted by the Tone Geometry Parameter. In terms of what is predicted by chance, this type of case should represent just over one-quarter of the languages. In this group of languages, it represents only 8%. If this is more than an accident of sampling and is a true reflection of the rarity of this type of language, some explanation is in order.

The explanation might lie in an acquisition account. It may be that children "cannot diagnose" where tone is represented in a language that does not provide sufficient clues. If tone reduplication can be accomplished with either segmental or prosodic tone, then tone reduplication by itself is not an indication of how tone is represented. Having segment-tone interactions along with tone reduplication may be preferred because it is a clear signal that tone is segmental. Since knowing how tone is represented is crucial to understanding the phonology of a tone language, children must be provided with enough information to develop a representation of tone appropriate to their language. Combinations of behavior that reinforce each other may therefore be favored in order to ease acquisition of the language.

On the surface, languages like Shanghai Chinese seem to present a problem for the Tone Geometry Parameter. There is evidence of segment-tone interactions in Shanghai in the form of morpheme structure constraints (given in Appendix B). One may be tempted to say that tone does not reduplicate in this language because tones of the base are not seen on the reduplicated affix. A case like Shanghai does not supply evidence for the Tone Geometry Parameter, but neither is it a counter-example.

There is no way to determine if Shanghai reduplicates tone or not. Shanghai has a rule which deletes all tones on non-initial morphemes in compounds and other phonological words (Shen 1987; Selkirk & Shen 1988). Given any two morphemes, only the tones of the first are preserved as shown schematically below:

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 371

(19)

HL	+	HL	→	HL
σ		σ		σσ
		+MM'	→	HL
		+LM'	→	HL
		+H	→	HL
		+LM	→	HL

In reduplication, therefore, all tones on the non-initial morpheme are deleted, the tones of the initial morpheme spread, and default low tones are inserted on any remaining syllables. Let us suppose for a moment that tones are not copied. The default low tone will automatically show up on the second morpheme. If, on the other hand, tones are copied in reduplication, they will be deleted and the morpheme will show up on the surface with the default low tone. The only way to recognize if the tones had copied is if there were any evidence of them left behind after deletion. If, for example, the tones of the copied morpheme interacted with the tones of the original morpheme and changed them in a predictable way we would have evidence that the tones had copied.

Unfortunately, Shanghai has no tone sandhi that would allow us to detect this.

Shen (pc), a native speaker of Shanghai, confirms that there is no way to diagnose whether Shanghai reduplicates tone or not. I therefore assume that tone does copy in reduplication. This is done on purely theoretical grounds since the empirical evidence is inconclusive. The Tone Geometry Parameter predicts that if a language has segment-tone interactions it will also reduplicate tone. Since nothing in Shanghai contradicts this claim, this is the position I am taking.

6. Areas for further investigation

The Tone Geometry Parameter has a number of consequences in the phonology of tone languages. There are two main areas of investigation that need to be pursued in light of the patterns noted in the previous section: (1) research to further define and refine the Tone Geometry Parameter. This includes determining what counts as evidence for the phonological representation of tone in feature geometry. (2) Re-evaluating the tonal phonology of languages in light of the arguments presented here.

Tone stability is an area that has been used in the past to argue for the prosodic nature of tone. It would be interesting if stability effects were only found in languages which otherwise indicate that they represent tone prosodically. However, it does not seem clear that stability effects are strong evidence in any direction. Since tone spreading is a very common process, it would be natural to look at tone stability as a case of tone spreading before deletion of a vowel. In Kirundi, a Bantu language of Burundi, hiatus is resolved by deletion of the first vowel. Goldsmith (1990) claims that the tone of the deleted vowel is preserved and associates to the following vowel¹⁰:

(20) umugoré + ararima → umugorárima

¹⁰Goldsmith does not give a gloss for this form. It means something like "that woman hoes".

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 373

licensed in word-final position in Javanese Total Segment Reversal (Bagemihl 1988):

- (26) (a) [botjah] *boy* → [hatjob]
 (b) [dolanan] *play* → [nanalod]

Licensing, then, follows a more permissive, possibly default, set of requirements in language games. Assuming prosodic tone to be the default and segmental tone to be the marked case, tone in language games would behave like prosodic tone regardless of the geometry of tone in the natural language.

Finally, the Tone Geometry Parameter has implications for the theory of feature geometry. Other proposals have been made which suggest that phonological representations are fixed on a language particular basis (Yip (1990) proposes double dependency of [lateral] and [murmur]; Piggott (1992) suggests that the feature [nasal] can be dominated either by the Soft Palate Node or by the Spontaneous Voicing Node). These are just two examples which counter the notion that dependency relations in feature geometry are universally determined. The goal of feature geometry, however, is to provide a universal explanation for the behavior of languages. We must therefore be careful to constrain the differences allowed individual languages so that the explanatory power of the geometry is not lost.

It is interesting to examine which features have fueled language-specific claims for feature geometry. Manner features have been the most troublesome. It is reasonable to ask if there is something about the class of manner features which disposes it, or even "licenses" it, to vary in the phonological geometry cross-linguistically. Yet even defining how inclusive the class of manner features should be is not straight forward. This question leads us to ask where tone fits into the schema of feature classes. This is one direction to take in looking to give adequate power to feature geometry while continuing to restrain it in order to preserve its explanatory abilities.

7. Conclusion

Some languages reduplicate tone, while others do not. We have seen that the location of tone in the phonological representation makes a prediction about the behavior of tone in reduplication. The presence of segment-tone interactions is also dependent on whether tone is represented under the laryngeal node or in the prosodic structure above the root node. If tone is segmental, it has the chance to interact with laryngeal features. Segmental tone also must copy in reduplication just like any other segmental feature. A theory which allows only for segmental tone cannot account for languages that do not reduplicate tone. On the other hand, a theory providing only prosodic tone gives no explanation for the absolute correlation between segment-tone interactions and tone reduplication. The proposal laid out in this paper, the Tone Geometry Parameter, claims that the location of tone in the phonological representation is fixed on a language particular basis: some languages have segmental tone while others have prosodic tone. The behavior of tone in reduplication is a direct result of this representational difference.

Appendix A Reduplication¹²

Language Family

Austro-Asiatic

Vietnamese:

(1) Tone reduplication

noi H M' <i>talk</i>	→	noi-noi H M' H M' <i>keep talking and talking</i>
-----------------------------------	---	--

(2) Tone non-reduplication

bi L <i>be big</i>	→	bi bi H L <i>be very big</i>
-------------------------------	---	---

Bantu

Kihehe:

Tone non-reduplication

(1)

ku-ha:ta H H L <i>to ferment</i>	→	ku-ha:ta-ha:ta H L L H L <i>to ferment a bit</i>
---	---	---

(2)

ku-tova H H L <i>to beat</i>	→	ku-tova-tova H L L H L <i>to beat a bit</i>
---	---	--

Kinande:

Tone non-reduplication

(1)

o-ku-boko M H M H <i>an arm</i>	→	o-ku-boko-boko M H M H M M <i>a real arm</i>
--	---	---

(2)

o-mu-longo M M M L <i>a village</i>	→	o-mu-longo-longo M M M M M L <i>a real village</i>
--	---	---

¹²The representation of tones used in this appendix is not meant to make any theoretical claims. It was chosen only for consistency and ease of exposition.

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 375

Shona:

Tone non-reduplication

- (1)
- | | | |
|-------------------|---|-------------------------------|
| t - a - f a m b a | → | t - a - f a m b a - f a m b a |
| | | |
| L H L | | L H L L L |
| <i>we walked</i> | | <i>we keep walking</i> |
- (2)
- | | | |
|--------------------|---|--|
| k u - s i m u k a | → | k u - s i m u k a - s i m u k a |
| | | |
| L H H H | | L H H H L L L |
| <i>to stand up</i> | | <i>to keep getting up all the time</i> |

ChadicMargi:

Tone reduplication

- (1)
- | | | |
|----------------------|---|-----------------------------|
| p ə r d a | → | p ə r d a - p ə r d a |
| | | |
| H H | | H H H H |
| <i>sinew, tendon</i> | | <i>sinewy piece of meat</i> |
- (2)¹³
- | | | |
|--------------|---|---------------------|
| m ə m u | → | m ə m ə - m ə m u |
| | | |
| L L | | L L L L |
| <i>honey</i> | | <i>corn disease</i> |
- Ngizim:
- Tone reduplication
- (1)
- | | | |
|------------|---|--------------------------|
| g ə n u | → | g ə n a n u |
| | | |
| L H | | L L H |
| <i>get</i> | | <i>go around getting</i> |
- (2)
- | | | |
|-----------------|---|-----------------|
| ɓ ə r u | → | ɓ a ɓ ə r u |
| | | |
| L H | | L L H |
| <i>separate</i> | | <i>peel off</i> |

KwaAkan:

Tone non-reduplication

- (1)
- | | | |
|--------------|---|-----------------------|
| k a s a | → | k a s a - k a s a |
| | | |
| L H | | L H L L |
| <i>speak</i> | | <i>speaking a lot</i> |

¹³In Margi [u] is an allophone of [ə]. The phoneme is [ə] and the [u] only shows up word-finally.

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 377

- (2)
- | | | |
|---|---|---|
| i š u

H H
<i>you finish it</i> | → | i - i š u - š u

H H H L
<i>you all finish it</i> |
|---|---|---|

Sino-Tibetan**Lahu:****Tone reduplication**

- (1)
- | | | |
|-------------------------------------|---|---|
| m a

H
<i>be numerous</i> | → | m a - m a

H H
<i>very much</i> |
|-------------------------------------|---|---|

- (2)
- | | | |
|---------------------------------|---|--|
| q ε

L
<i>be wide</i> | → | q ε q ε

L L
<i>be very wide</i> |
|---------------------------------|---|--|

Mandarin:

- (1) Tone reduplication
- | | | |
|-------------------------------------|---|---|
| z h a n g

H
<i>sheet</i> | → | z h a n g - z h a n g

H H
<i>every sheet</i> |
|-------------------------------------|---|---|
- (2) Tone non-reduplication
- | | | |
|-----------------------------------|---|---|
| h a o

LM
<i>good</i> | → | h a o - h a o - r - d e

LM H H
<i>vividly good</i> |
|-----------------------------------|---|---|

Shanghai:**Tone reduplication¹⁴**

- | | | | | | | | | | | | | | | |
|-------------------|---------|--|---------|---------|--|--|---|---|---------|---------|--|--|---|---|
| t s a ?

H | → | <table style="margin: auto;"> <tr> <td style="text-align: center;">t s a ?</td> <td style="text-align: center;">t s a ?</td> </tr> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> </tr> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">H</td> </tr> <tr> <td style="text-align: center;">t s a ?</td> <td style="text-align: center;">t s a ?</td> </tr> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> </tr> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">L</td> </tr> </table> | t s a ? | t s a ? | | | H | H | t s a ? | t s a ? | | | H | L |
| t s a ? | t s a ? | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| H | H | | | | | | | | | | | | | |
| t s a ? | t s a ? | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| H | L | | | | | | | | | | | | | |

¹⁴I have noted that Shanghai reduplicates tone because of purely theoretical assumptions. Because of the structure of Shanghai, there is no way to determine if tone is reduplicated or not. Since Shanghai has segment-tone interactions, the Tone Geometry Parameter predicts it must reduplicate tone. I have assumed that it does, despite the subsequent deletion of all tones on the non-initial morpheme. See footnote 6 in the body of the paper for discussion.

Appendix B Segment-Tone Interactions

Chadic

Ngizim:

/mùgbá + báí/
/màarém + tén/
š iitá + báí/

→ [mùgbà báí]
→ [màarèm tén] /
→ [š iitá báí]
*[š iità báí]

"it's not a monitor"

"it's not a pepper"

Kwa

Ewe:

	Low Tone	Mid Tone	High Tone
Voiced Onset	vù <i>fight</i>	----	----
Voiceless Onset	----	fu <i>sea</i>	fú <i>bone</i>
Sonorant Onset	----	mo <i>face</i>	mó <i>road</i>

Sino-Tibetan

Lahu:

Onsets	Mid Tone	High Falling Tone	Low Falling Tone	Low Tone
Aspirated Consonants	√	√	X	X
Glottalized Consonants	√	√	√	X
Plain Obstruents	√	√	√	√
Nasals	√	√	√	√
f, ʃ, h	√	X	X	√

REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 379

Shanghai:

<i>Tone</i>	<i>Co-occurrence Restrictions</i>
High Falling	Only after voiceless onsets
Mid Rising	Only after voiceless onsets
Low Rising	Only after voiced onsets
High (short)	Only after voiceless onset with glottal stop coda
Low (short)	Only after voiced onset with glottal stop coda

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REDUPLICATION AS EVIDENCE FOR THE GEOMETRY OF TONE 381

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